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Published in:
Symposium i anvendt statistik

Publication date:
2008

Document version
Publisher's PDF, also known as Version of record

The Discovered Preference Hypothesis – An empirical test

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Abstract

Using stated preference methods for valuation of non-market goods is known to be vulnerable to a range of biases. Some authors claim that these so-called anomalies in effect render the methods useless for the purpose. However, the Discovered Preference Hypothesis, as put forth by Plott [31], offers an interpretation and explanation of biases which entails that the stated preference methods need not to be completely written off. In this paper we conduct a test for the validity and relevance of the DPH interpretation of biases. In a choice experiment concerning preferences for protection of Danish nature areas from new motorway development, we find that respondent preferences are susceptible to starting point bias. In particular, our results show that the bias is gender-specific as only female respondents are significantly biased. Importantly, we find that the impact of the starting point bias decays as respondents evaluate more and more choice sets. This finding supports the Discovered Preference Hypothesis interpretation and explanation of starting point bias.

Keywords: Discovered preference hypothesis, Choice experiment, Starting point bias

Introduction

A number of methods exist for assessing the economic value of non-marketed goods, such as for instance recreation in nature areas with public access. These methods rely on surveying people's preferences, revealed or stated, for the relevant good, and these preferences then serve as a measure of the societal welfare economic value of the good. However, the economic valuation methods, in particular the stated preference methods Contingent Valuation (CVM) and Choice Experiments (CE), have been subject to a great deal of criticism. This is due to the fact that the preferences elicited in stated preference methods in practice are often found not to conform to the standard economic theories of preference underpinning the methods.

Such inconsistencies between an individual's responses and the theory that is being used to organize the survey data are referred to as *anomalies* [34]. But does this ultimately imply that the observed anomalies render economic valuation studies useless as means of measuring and monetarizing respondent preferences, as have been argued from a *constructed preference* view [33] or a *prospect theory* view [21, 37]? Amongst others, Sugden [34] and Bateman *et al.* [4] argue that this is not necessarily the case[1]. Instead of abandoning the methods, we should recognise the existence and importance of anomalies and preferably investigate strategies for dealing with them.

As discussed in Braga & Starmer [9], one such strategy might be to interpret and explain anomalies in terms of the Discovered Preference Hypothesis (DPH) [31]. The DPH states that when respondents are faced with new decisions in unfamiliar environments, as is typically the case in non-market valuation surveys, initial decisions will exhibit large randomness and little conformity with standard preference theory, e.g. rationality. However, as choices are repeated and respondents gain familiarity with the decision environment, decisions will progressively exhibit less randomness and greater rationality, i.e. anomalies will decay. In other words, behaviour initially deviates from, but with experience converges to, the predictions of standard theory. It is thus argued that by "training" respondents their preferences become more stable and rational.

In this paper we make a novel contribution to the DPH interpretation of anomalies. In a choice experiment study, we first analyse for potential starting point bias[2] (SPB), and our analyses confirm that this anomaly is indeed present in the data. Surprisingly however, this finding is gender specific, as it is only female respondents who are found to be susceptible to this bias. Secondly, in order to test the relevance of the DPH as a possible explanation for this anomalous behaviour, we test for decaying impact of the SPB. Even though the evidence is not rock-solid, we do find results to be in favour of the DPH.

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[1] In fact, anomalies exist in all stated preference and revealed preference surveys including lab and field experiments. Even real behaviour can be anomalous [26].

[2] In the literature, the term 'anchoring' is often used instead of SPB to describe more or less the same effect. For simplicity, only the term SPB will be used in the remainder of this paper. This bias emerges when respondents are uncertain about their true preferences for the good. As a consequence, they then regard the presented price in a Dichotomous Choice Contingent Valuation Method (DC-CVM) question as conveying an approximate value of the good's "true" or "correct" value and therefore they anchor their willingness-to-pay (WTP) in this value [18, 22, 29]. Several surveys have studied the influence and importance of SPB in DC-CVM, see e.g. [2, 8, 10, 13, 19, 38]. In general, the results show that SPB has a significant influence on the derived WTP. Stated WTP thus becomes a function of the "response path" and not only a function of the respondent's true preferences as standard welfare-economic assumptions prescribe. The construct underlying CE is closely related to the DC-CVM in that they share the same random utility framework [15]. In effect, DC-CVM can be seen as a special case of CE with only one choice set. With this close relation between CE and DC-CVM in mind, the *a priori* expectation would be that CE is equally prone to SPB. However, to date, very few studies have investigated the possible existence of SPB in CE.

Procedure

Formally, the initial test for SPB was carried out by using a two-split sample design. In both samples, respondents were introduced to an "Instructional Choice Set" (ICS), which was simply an example of the subsequent actual choice sets used in the survey for preference elicitation. The ICS was introduced as a part of the scenario, describing the hypothetical market put forward[3]. To test for SPB, we fixed the prices used in the ICS at different levels in the two split-samples. In all other respects the questionnaires were kept identical in the two samples. In sample A the ICS displayed prices of 400 DKK and 1,100 DKK for alternatives 1 and 2, respectively. Sample B, on the other hand, employed a lower set of prices at 100 DKK and 200 DKK for alternatives 1 and 2, respectively. If the price levels in the ICS are in fact perceived as cues of the true social value, then one would expect the distribution of choices between the two alternatives and the status quo to differ between the two samples. More specifically, compared to the distribution in sample A, it would be expected that the lower-priced ICS in sample B, would displace the distribution of choices towards the zero-priced status quo alternative and/or the cheaper of the policy generated alternatives. As a logical consequence, sample B would then yield lower aggregate WTP estimates than sample A. If tests cannot reject that this is the case, the presence of SPB in the dataset is established.

Conditional on acceptance of the DPH, we would expect SPB, if present, to disappear as the respondents become more experienced with the valuation setup and the good in question. Accordingly, an initially established overall SPB in the dataset might conceal the fact that the choices in the first choice sets are heavily anchored in the ICS whereas the bias decreases in the following choices. If a learning effect in accordance with the DPH gradually reduces the severity of SPB, then choice of action and utility should converge asymptotically to the same level in sample A and B, effectively eliminating the bias, as the number of choice sets being valued is increased. Consequently, our main hypothesis can be put forward, conditional on the presence of SPB in the data:

(H1) SPB is equally present throughout the sequence of choice sets.

Failure to reject this hypothesis will indicate that preferences do not converge and that the SPB from the ICS carries over to all remaining choice sets. In that case the SPB might not be interpretable in terms of the DPH but it is rather an initially coherent type of anomaly which would severely invalidate the validity of estimates [3, 4]. On the other hand, rejection of the hypothesis will favour the DPH interpretation of anomalous behaviour.

[3] For a short description of the survey design, see Ladenburg & Olsen [23]. For an in-depth description of the original study, see Olsen et al. [30]

Study design

During the past ten years, almost 200 kilometres of new motorways have been built in Denmark. In order to assess the impacts on recreational benefits when placing new motorways through nature areas, the conducted survey examines the recreational benefits associated with reducing the impact of new motorways on different types of nature. In a questionnaire, respondents were faced with a scenario description based on the current plans regarding future motorway development. The scenario assumed that 100 kilometres of new motorways will be built over the next ten years. In accordance with Lancaster's [24] *attribute theory of value*, three different types of nature were chosen as attributes in the study. A zero-priced status quo alternative was defined on the basis of the present area distribution of these nature types in Denmark. The attributes as well as the applied attribute levels are displayed in table 1. Collection of data was carried out through an online internet survey. Respondents were sampled from a nationwide internet panel consisting of approximately 17,000 people.

Table 1
Attributes and attribute levels used in the CE survey

Attribute (type of nature)	Level (km new motorway through area)
Forest	0 km, 5 km, 10 km
Wetland	0 km, 2.5 km, 5 km
Heath/pastoral area	0 km, 2.5 km, 5 km
Arable land[a]	80 km, 82.5 km, 85 km, 87.5 km, 90 km, 92.5 km, 95 km, 97.5 km, 100 km
Annual extra tax payment per household[b]	(0 DKK), 100 DKK, 200 DKK, 400 DKK, 700 DKK, 1100 DKK, 1600 DKK

[a] As each alternative had to sum to 100 kilometres of new motorway, a fourth supplementary attribute, 'arable land', was introduced. This attribute functioned as an accumulation attribute, the level being dependent on the level of the other attributes.
[b] 100 DKK ≈ 13.4 EUR

Results

With rates of response at 53% and 48%, a total of 294 and 285 useable responses were collected for sample A and sample B, respectively. Analysis of a range of demographic background characteristics revealed that the two respondent samples only differ significantly with respect to gender (χ^2=10.8, p=0.001). In sample A, women account for 52% of the total whereas this share is only 43% in sample B. Due to the different distributions of gender, the following analyses are carried out on an overall level as well as on a gender specific level. This approach is taken in order to ascertain whether potential differences with regard to preferences in the two samples are caused merely by an overall impact of the differing ICSs, or if there is a gender specific effect.

The parametric analysis
Multinomial Probit Models describing the elicited preferences for samples A and B are presented in table 2. This type of model was chosen to avoid the restrictive IIA assumption, which in the early stages of analysis was found to be violated.

Parameter estimates denote the marginal utility associated with a change from the status quo attribute levels [1]. The parameter estimates for protecting forest (Forest_), wetland (Wetland_) and heath[4] (Heath_) are significant and positive in both samples, in the main models as well as in the gender specific models. Dividing with the negative price parameter estimates results in positive estimates of WTP to avoid the level-specified amount of kilometres of motorway through the specific nature types. Given potentially different scale parameters in the two models, the parameter estimates cannot be directly compared across models [27, 35]. But a direct comparison *can* be made with regard to the WTP estimates, as the scale parameter cancels out in this calculation [36].

Differences in WTP
The numerical differences in WTP estimates are reported in the far right column of table 2. In the main models, WTP estimates in sample B are generally lower than in sample A. The same tendency is apparent in the gender specific models. However, for male respondents the differences in WTPs are smaller than is the case for female respondents. Taken at face value these numerical differences suggest that SPB does indeed cause female respondents to express lower WTP in sample B than in sample A. To ascertain whether the differences are significant a t-test is carried out for each of the WTP differences, testing the null of equal WTP in the two samples[5].

In the main model the results of the tests for identical WTPs between the two samples support the first notion of WTP estimates in sample B being lower than in sample A. More specifically, with regard to the WTP for the maximum protection of wetland and heath, the t-tests reject the null. These findings indicate that WTP in sample B is indeed lower than in sample A. Similar results are evident in the gender specific model for females, though here significant differences are established for Forest_max and not Heath_max. For male respondents none of the t-tests reject the null.

[4] The medium level of protection for the heath attribute (Heath_med) is not included in the model as this parameter estimate was found not to be significantly different from zero.
[5] As the two samples are independent a standard t-test is applied. However, referring to Poe et al. [32], the complete combinatorial approach would give the exact measure of difference between two independent samples. Accordingly, the t-tests presented might underestimate the level of significance of difference in WTP. Importantly, rejection of equal WTP at the 95% level is still a valid rejection, but it could potentially be rejected at an even higher level of significance.

Table 2
Results of multinomial probit model.

Parameter	Sample A		Sample B		ΔWTP (CI_A vs CI_B)[b]
	Estimates	WTP [95% CI][a]	Estimates	WTP [95% CI]	
Forest_max (0 km)					
All	1.0347***	895 [644-1146]	0.8147***	640 [425-855]	255(-)
Male	1.0617***	844 [653-1035]	1.4189***	798 [607-990]	46(-)
Female	0.9972***	938 [722-1154]	1.1993***	530 [389-670]	408(+)
Forest_med(5 km)					
All	0.4975***	430 [275-585]	0.3990***	313 [172-454]	117(-)
Male	0.4534***	360 [186-535]	0.6756***	380 [212-548]	-20(-)
Female	0.5306***	499 [312-686]	0.6204***	274 [134-414]	225(-)
Wetland_max(0km)					
All	0.8839***	765 [538-992]	0.5365***	421 [237-605]	344(+)
Male	0.8592***	683 [491-875]	0.9697***	546 [350-742]	137(-)
Female	0.8853***	833 [615-1050]	0.7953***	351 [206-497]	482(++)
Wetland_med(2.5 km)	0.5073***	439 [258-620]	0.3354***	263 [108-418]	176(-)
All	0.5551***	441 [270-613]	0.5341**	301 [126-475]	140(-)
Male	0.4444***	418 [225-611]	0.5968**	264 [123-404]	154(-)
Female					
Heath_max(0 km)					
All	0.3606***	312 [181-443]	0.1509*	119 [9-229]	193(+)
Male	0.4619***	367 [221-514]	0.3144*	177 [31-323]	190(-)
Female	0.2550**	240 [76-404]	0.1794NS	79 [-46-254]	161(-)
Status quo					
All	0.0996NS	86 [-10-182]	0.1649**	130 [42-218]	-44(-)
Male	-0.0069NS	-5 [-144-133]	0.2465*	138 [-10-287]	-143(-)
Female	0.1962*	184 [18-351]	0.2772NS	122 [-9-254]	62(-)
Price					
All	-0.0012***		-0.0013***		
Male	-0.0013***		-0.0018***		
Female	-0.0011***		-0.0023***		
Std_1					
All	1.6619***		1.1082***		
Male	1,7345***		1.5391***		
Female	1.5307***		0.8483***		
N	1764, 846, 918		1710, 978, 732		
Simulations	250		250		
LL(0)	-1938.2, -929.5, -1008.6		-1879.0, 1074.5, 804.3		
LL(b)	-1650.5, -796.5, -847.7		-1581.8, -929.4, -644.2		
Pseudo-R^2	0.148, 0.143, 0.160		0.158, 0.135, 0.199		

* indicates significance at 95% level, ** at 99% level and *** at 99.9% level. NS indicates no significance.

[a] 95% confidence intervals are estimated using the Delta Method in accordance with Greene [14] and Hanemann & Kanninen [16].

[b] CI_A vs CI_B denotes a t-test of overlap between the two confidence intervals. (-) indicates no significant difference in WTP. (+) indicates no overlap at the 95% level, (++) at the 99% level, and (+++) at the 99.9% level.

Differences in preferences

An alternative way to examine the effects of the ICS is to consider effects on overall preferences. To formally test the hypothesis of identical *preferences* in the two samples, a likelihood ratio test for nested models is conducted. The test statistic $LR = -2(LL_{pooled\ model} - (LL_{sampleA} + LL_{sampleB}))$ is asymptotically χ^2-distributed with $(K+d_\mu)$ degrees of freedom, where K is the number of variables in the models and d_μ is a dummy taking value one if the ratio μ between scale parameters is found to be significantly different from one, zero otherwise [35]. Pooling the two data sets yields a LR test statistic of 21.73 for the main model. With 8 degrees of freedom[6], this is significant with a p-value of 0.0054. The hypothesis of identical preferences in samples A and B is therefore rejected. The test statistic for female respondents in the two samples is 31.41, which is highly significant. It is thus affirmed that female respondents in sample A have expressed preferences different from those expressed by female respondents in sample B. For male respondents, the test statistic is only 5.95 which is not significant at a 95% significance level. Thus, it cannot be rejected that male respondents in the two samples have stated identical preferences. In other words, the presence of SPB is established, but it can only be ascribed to female respondents.

Choice set number sensitivity – testing the DPH

The above findings effectively enables a test our main hypothesis (H1). Rejection of identical preferences across samples A and B might be choice set sequence sensitive due to a potential learning effect as prescribed by the DPH. Due to the character of the experimental design, the information on preferences obtainable from a single choice set does not allow for a fully specified model as presented in table 2. Hence, the test is based on subgroups of three choice sets, as this was identified as the lowest number allowing for full model specification. The LR tests for identical preferences are carried out on gender specific levels in table 3.

The results suggest that the SPB observed for female respondents might be choice set number sensitive and thus subject to a learning effect. The tests reject identical preferences of female respondents in samples A and B when based on choice sets 1-3, 2-4 and 3-5, respectively. However, applying the test to choice sets 4-6, the hypothesis cannot be rejected on the 95% significance level. Extrapolating this tendency implies that the SPB is reduced by the learning effect and ultimately the preferences will converge at a stable level, in accordance with the DPH. This interpretation of results is however subject to certain reservations, as the conclusion rests on a p-value of 0.0546 which is just borderline non-significant at the 95% confidence level. Hence, the learning effect is clearly not as outspoken as one would conclude at first glance in a strictly discrete view of confidence limits, and SPB, while diminishing, still seems to persist if confidence limits are slightly relaxed.

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[6] Based on a grid search procedure, the ratio between scale parameters, μ, in samples A and B is estimated to be insignificant in all three models. Accordingly, the number of degrees of freedom in the test is 8.

Table 3
Gender specific LR test for equality of model parameters based on subsets of choice sets

	Choice sets	$LL_{Sample\ A} + LL_{Sample\ B}$	$LL_{pooled\ model}$	LR-test, DF=8	P-value	CI_A vs CI_B[a]
Male	1, 2, 3	-287.96-324.67 = -612.63	-618.05 (μ=1.18^{NS})	10.84	0.2109	0
	2, 3, 4	-283.54-313.22 = -596.75	-599.42 (μ=1.27^{NS})	5.34	0.7207	0
	3, 4, 5	-273.86-323.63 = -597.49	-598.57 (μ=0.92^{NS})	2.16	0.9757	0
	4, 5, 6	-356.07-427.56 = -783.64	-784.55 (μ=1.01^{NS})	1.82	0.9860	0
Female	1, 2, 3	-441.33-340.15 = -781.48	-790.76 (μ=1.15^{NS})	18.56	0.0174	2
	2, 3, 4	-433.11-336.31 = -769.42	-783.53 (μ=1.05^{NS})	28.22	0.0004	2
	3, 4, 5	-427.19-327.59 = -754.78	-766.26 (μ=1.13^{NS})	22.96	0.0034	2
	4, 5, 6	-399.06-295.73 = -694.79	-702.41 (μ=1.04^{NS})	15.24	0.0546	0

[a] CI_A vs CI_B denote the number of attributes, for which the WTP 95% confidence intervals do not overlap significantly between sample A and B.

When looking at male respondents, the probabilities of identical preferences increase as more choice sets are evaluated, even though the hypothesis of equal preferences cannot be rejected in any of the four cases. This implies that the preferences converge to a more stable level which suggests that even though men are not subject to SPB when given an ICS, they still go through a learning process.

The suggested choice set number sensitivity for females is supported by the test results in the far right column of table 3. For female respondents, two attributes have non-overlapping confidence intervals in the first three cases. However, moving to choice sets 4-6 this number decreases to zero which could be interpreted as further evidence in support of the DPH. For male respondents, the number of attributes for which the WTP 95% confidence intervals do not overlap is zero in all cases.

Discussion

In this paper we find that preferences of especially women, even though subject to anomalies in terms of SPB, may converge towards the same level in the two samples. In effect, the results suggest that the SPB decays as more choice sets are evaluated. The decay of anomalies is clearly in accordance with the DPH. Previous studies concerning the DPH interpretation of decaying anomalies have found similar results, though none of these look at potential gender differences. In a literature review, Braga & Starmer [9] find some, but not unequivocal, support for the DPH. Cherry *et al.* [12] and List [25] find that people generally become more rational through refining values, not by changing preferences, and that their stated values become more consistent with their true preferences as market experience increases through a process of repetition

and learning. Bateman *et al.* [5] and Hutchinson *et al.* [20] find strong evidence of learning effects in a CE-study as well as a CVM study, respectively.

In this line, Hanley & Shogren [17], Bjornstad *et al.* [7], and Carlsson & Martinsson [11] suggest that some form of "warm-up" choices or market-like training of respondents might circumvent initial instability of preferences and reduce irrational behaviour in the preference elicitation questions. In the words of Hutchinson *et al.* [20, p.12] *"an ideal elicitation format should use repetition and exposure to allow respondents the opportunity to gain experience of the valuation mechanism (institutional learning) and experience of the good under investigations (value learning) prior to the use of an incentive compatible valuation question".* Such a "learning" approach is supported by Bateman *et al.* [4] who further advocate the DPH interpretation over other potential conceptions of individual's preferences. However, the DPH does not hold any *a priori* expectations with regard to the observed gender differences. Our results, as well as those of Mason *et al.* [28], suggest that an expansion of the DPH with the gender difference aspect is in order. Further, our findings suggest that the learning approach mentioned above should allow for differentiating between men and women in the learning process, for instance by giving women more warm-up choices than men.

Use of an information choice set

In our study we used an ICS with a dual purpose. The rationale for this was, firstly, to experimentally control for the SPB by varying the prices in the ICS in the two samples. Secondly, in line with the DPH and Hanley & Shogren's [17] and Carlsson & Martinsson's [11] suggestions, it was to provide respondents with the opportunity to engage in institutional, as well as value learning.

It might be argued that by introducing respondents to the ICS, we effectively induce an anchor. Hence, the ICS could actually be the cause of the observed SPB. However, this argument misses a very central point, namely that respondents are initially uncertain and maybe even unaware of their own preferences. According to the DPH, searching for an initial starting point is just a natural part of the process of learning about own values. Had the ICS not been included in the study, it is more than likely that respondents would have looked to the first of the choice sets for a starting point reference instead. In that case, the initial level of the SPB would be set by the price levels in the first of the actual choice sets, thus affecting choices in the subsequent choice sets. Starting with a relatively low-priced choice set would then lead to low estimates of WTP, whereas starting with prices in the upper end of the bid range would lead to higher WTP estimates.

The ICS employed in the present study is likely to have made the decision environment more familiar and increased respondents' awareness of own preferences in order to remove SPB from the dataset. Even so, the resulting anomaly decay in the

data generating process for female respondents rests on a very strict interpretation of confidence limits. It is quite possible that female respondents still experience uncertainty in the following choice sets despite being presented with the initial ICS. Thus, the choice will still reflect deviations between the stated and the true preferences. Relaxing the confidence limits, one might argue that SPB has persisted throughout female's choices. Elaborating on this, one might find results speaking in favour of other conceptions of individual's preferences than the DPH, such as for instance coherent arbitrariness or prospect theory views [3, 21, 33, 37]. This is clearly an area warranting further research.

It might follow that instead of just one, a series of two or maybe even three ICSs or practicing choice sets ought to have been introduced prior to the actual choice sets in order to further facilitate the learning process and make behaviour converge more towards the true preferences. A discussion of the appropriate number of ICSs to use is similar to the issue of how many choice sets should be evaluated before the respondent gains sufficient experience for stated preferences to converge to true preferences. Even though this issue has been treated in Bateman *et al.* [4], Bateman *et al.* [5], Binmore [6], Hanley & Shogren [17] and Carlsson & Martinsson [11], no general guidelines have been put forward as to exactly how many choice sets are needed. This is worthy of further consideration and investigation in future research.

Conclusion

We find that preferences elicited in a Choice Experiment are subject to Starting Point Bias. More specifically, female respondents' preferences are affected by this bias, whereas male respondents' are not. Thus, employing different sets of price levels in an Instruction Choice Set presented prior to the actual choice sets resulted in significantly different distributions of choices as well as significantly different preferences and estimates of WTP in two otherwise identical choice set designs. At first glance, this result might be discouraging for the future use of choice experiments as a means of assigning economic values to non-market goods. However, in the second part of analysis, results indicate that the impact of the SPB decays, as the number of choice sets evaluated by the respondent increases. This is in favour of the Discovered Preference Hypothesis interpretation of anomalous behaviour. Hence, researches should not refrain from using the choice experiment method on account of starting point bias, but they should be aware that respondents might require the opportunity to engage in learning about own preferences as well as the valuation instrument being applied in order to state their true preferences. Thus, inclusion of one or more information choice sets prior to the actual choice sets may offer a promising way of reducing the impact of SPB.

References

[1] W. Adamowicz, J. Louviere, M. Williams, Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities, J. Environ. Econom. Manage. 26 (3) (1994) 271-292.

[2] A. Alberini, M. Veronesi, J. C. Cooper, Detecting Starting Point Bias in Dichotomous-Choice Contingent Valuation Surveys, FEEM Working Paper No. 119.05, September 2005.

[3] D. Ariely, G. Loewenstein, D. Prelec, Coherent Arbitrariness: Stable Demand Curves Without Stable Preferences, Quart. J. Econ. 118 (1) (2003) 73-105.

[4] I. Bateman, D. Burgess, W. G. Hutchinson, D. I. Matthews, Preference Learning versus Coherent Arbitrariness: NOAA Guidelines or a Learning Design Contingent Valuation (LDCV), CSERGE Working Paper No. 18, 2006.

[5] I. Bateman, B. Day, D. Dupont, S. Georgiou, J. Louviere, S. Morimoto, P. Wang, Preference formation in choice experiments (CE): Task awareness and learning in the cognitive process, Thirteenth Annual Conference of the European Association of Environmental and Resource Economists (EAERE), June 2004.

[6] K. Binmore, Why Experiment in Economics?, Economic J. 109 (1999) F16-F24.

[7] D. Bjornstad, C. Ronald, O. Laura, A Learning Design for Reducing Hypothetical Bias in the Contingent Valuation Method, Environ. Resource Econ. 10 (3) (1997) 207-221.

[8] K. J. Boyle, R. C. Bishop, M. Welsh, Starting Point Bias in Contingent Valuation Surveys, Land Econ. 61 (1985) 188-194.

[9] J. Braga, C. Starmer, Preference Anomalies, Preference Elicitation and the Discovered Preference Hypothesis, Environ. Resource Econ. 32 (1) (2005) 55-89.

[10] T. A. Cameron, J. Quiggin, Estimation Using Contingent Valuation Data from a "Dichotomous Choice with Follow-up" Questionnaire, J. Environ. Econom. Manage. 27 (1994) 218-234.

[11] F. Carlsson, P. Martinsson, Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments, J. Environ. Econom. Manage. 41 (2001) 179-192.

[12] T. L. Cherry, T. D. Crocker, J. F. Shogren, Rationality spillovers, J. Environ. Econom. Manage. 45 (1) (2003) 63-84.

[13] Y. L. Chien, C. J. Huang, D. Shaw, A general model of starting point bias in double-bounded dichotomous contingent valuation surveys, J. Environ. Econom. Manage. 50 (2) (2005) 362-377.

[14] W. H. Greene, Econometric Analysis, Prentice-Hall International Inc., New York, 2003.

[15] M. W. Hanemann, Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses, Amer. J. Agr. Econ. 66 (3) (1984) 332-341.

[16] M. W. Hanemann, B. Kanninen, The Statistical Analysis of Discrete-Response CV Data, in: I. J. Bateman, K. G. Willis (Eds.), Valuing Environmental Preferences - Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries, Oxford University Press, Oxford, 1999.

[17] N. Hanley, J. F. Shogren, Is Cost Benefit Analysis Anomaly-Proof?, Environ. Resource Econ. 32 (1) (2005) 13-24.

[18] C. C. Harris, B. L. Driver, W. J. McLaughlin, Improving the contingent valuation method: A psychological perspective, J. Environ. Econom. Manage. 17 (3) (1989) 213-229.

[19] J. A. Herriges, J. F. Shogren, Starting Point Bias in Dichotomous Choice Valuation with Follow-Up Questioning, J. Environ. Econom. Manage. 30 (1) (1996) 112-131.

[20] W. G. Hutchinson, I. Bateman, D. Burgess, D. I. Matthews, Learning Effects in Repeated Dichotomous Choice Contingent Valuation Questions, The Royal Economic Society Annual Conference, Paper no. 59, April 2004.

[21] D. Kahneman, A. Tversky, Prospect Theory: An analysis of Decision under Risk, Econometrica 47 (2) (1979) 263-291.
[22] D. Kahneman, P. Slovic, A. Tversky, Judgement under Uncertainty: Heuristics and Biases, Cambridge University Press, New York, 1982.
[23] J. Ladenburg, S. B. Olsen, R. C. F. Nielsen, Reducing hypothetical bias in Choice Experiments – Testing an Opt-Out reminder, European Association of Environmental and Resource Economists 15th Annual Conference, Thessaloniki, Greece, 2007.
[24] K. J. Lancaster, A New Approach to Consumer Theory, J. Polit. Economy 74 (2) (1966) 132-157.
[25] J. A. List, Does Market Experience Eliminate Market Anomalies?, Quart. J. Econ. 118 (1) (2003) 41-71.
[26] J. A. List, R. P. Berrens, A. K. Bohara, J. Kerkvliet, Examining the Role of Social Isolation on Stated Preferences, Amer. Econ. Rev. 94 (3) (2004) 741-752.
[27] J. Louviere, D. A. Hensher, J. Swait, Stated Choice Methods. Analysis and Applications, University Press, Cambridge, UK, 2000.
[28] C. F. Mason, O. R. Phillips, D. B. Redington, The role of gender in a non-cooperative game, J. Econ. Behav. Org., 15 (2) (1991) 215-235.
[29] R. C. Mitchell, R. T. Carson, Using Surveys to Value Public Goods: The Contingent Valuation Method, RFF, Washington D.C., USA, 1989.
[30] S. B. Olsen, J. Ladenburg, M. L. Petersen, U. Lopdrup, A. S. Hansen, A. Dubgaard, Motorways versus Nature - A Welfare Economic Valuation of Impacts, Report from FOI and IMV, Copenhagen, 2005.
[31] C. R. Plott, Rational Individual Behaviour in Markets and Social Choice Processes: The Discovered Preference Hypothesis, in: K. Arrow, E. Colombatto, M. Perlman, C. Schmidt (Eds.), Rational Foundations of Economic Behaviour, Macmillan Press Ltd., London, 1996.
[32] G. L. Poe, K. L. Giraud, J. B. Loomis, Computational Methods for Measuring the Difference of Empirical Distributions, Amer. J. Agr. Econ. 87 (2) (2005) 353-65.
[33] P. Slovic, The Construction of Preferences, Amer. Psych. 50 (1995) 364-371.
[34] R. Sugden, Anomalies and Stated Preference Techniques: A Framework for a Discussion of Coping Strategies, Env. Res. Econ. 32 (1) (2005) 1-12.
[35] J. Swait, J. Louviere, The Role of the Scale Parameter in the Estimation and Comparison of Multinomial Logit Models, J. Marketing Res. 30 (3) (1993) 305-314.
[36] K. Train, Discrete Choice Methods with Simulation, Cambridge University Press, Cambridge, 2003.
[37] A. Tversky, D. Kahneman, Rational Choice and the Framing of Decisions, J. Bus. 59 (4, pt.2) (1986) S251-S278.
[38] J. Whitehead, Incentive incompatibility and starting point bias in iterative valuation questions, Land Econ. 78 (2) (2002) 285-297.